

23. The method of claim 15, wherein said coating has a thickness in the range of about 4.0 microns to about 5.0 microns.

**REMARKS**

The Office Action dated October 25, 2000 has been carefully reviewed. Claims 1, 2, 5, 8, 10, and 14 are pending in this patent application. Claims 1, 2, 5, 8, 10, and 14 have been cancelled and new claims 15-23 have been added. Reconsideration of the patent application is respectfully requested in view of the following remarks.

**35 U.S.C. § 102(b) Rejection of Claims 1, 2, 5, and 8 (Watanabe et al. '644)**

Claims 1, 2, 5, and 8 were rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Watanabe et al. (U.S. Patent No. 5,118,644). Specifically, the Examiner states the following on page 1, lines 12 through 13 of the Office Action:

See Col. 4, lines 20-28, Col. 10, lines 19-25, and Col. 3, lines 55-59.

As indicated above claims 1, 2, 5, and 8 have been cancelled. New claims 15-23 have been added.

Discussion Re: Patentability of Claim 15

New claim 15 reads as follows:

15. A method of coating a portion of a glow plug, comprising:  
(a) disposing a silicon-based component on said portion of said glow plug, wherein said silicon-based component includes a rare earth-doped ceramic;  
(b) heating said silicon-based component to about 1250 C° or greater for about six to about twelve hours so as to form silica; and

(c) reacting said rare earth-doped ceramic with said silica so as to form a rare earth silicate coating on said silicon-based component...

Watanabe et al. is devoid of any discussion relating to disposing a silicon-based component on a portion of a glow plug. Accordingly, Watanabe et al. does not anticipate claim 15. Therefore, Applicants respectfully submit that claim 15 is in condition for allowance and action to that end is hereby solicited.

Discussion Re: Patentability of Claims 16-23

Claims 16-23 include claim 15 as a base claim. As a result, claims 16-23 are believed to be allowable for the reasons hereinbefore discussed with regard to claim 15. Accordingly, Watanabe et al. does not anticipate claims 16-23. Therefore, Applicants respectfully submit that claims 16-23 are in condition for allowance and action to that end is hereby solicited.

**35 U.S.C. § 102(b) Rejection of Claims 1, 2, and 8 (Kamatsu '302)**

Claims 1, 2, and 8 were rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Kamatsu (U.S. Patent No. 4,713,302). Specifically the Examiner states the following on page 1, line 15 of the office action:

See Col. 1, lines 40-48.

As indicated above claims 1, 2, and 8 have been cancelled. New claims 15-23 have been added. Like Watanabe et al., Kamatsu is devoid of any discussion relating to disposing a silicon-based component on a portion of a glow plug. Accordingly, Kamatsu does not anticipate claim 15. Therefore, Applicants

respectfully submit that claim 15 is in condition for allowance and action to that end is hereby solicited.

Discussion Re: Patentability of Claims 16-23

Claims 16-23 include claim 15 as a base claim. As a result, claims 16-23 are believed to be allowable for the reasons hereinbefore discussed with regard to claim 15.

Accordingly, Kamatsu does not anticipate claims 16-23. Therefore, Applicants respectfully submit that claims 16-23 are in condition for allowance and action to that end is hereby solicited.

**35 U.S.C. § 103(a) Rejection of Claims 10 and 14 (Koshkarian et al. '349 in view of Watanabe et al. '644 or Kamatsu '302)**

Claims 10 and 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Koshkarian et al. (U.S. Patent No. 5,578,349) in view of Watanabe et al. (U.S. Patent No. 5,118,644) or Kamatsu (U.S. Patent No. 4,713,302). Specifically the Examiner states the following on page 2, line 6 through line 18 of the office action:

Koshkarian et al (US5578349) discloses a silicon nitride glow plug with a protective coating thereon with a thickness of 1-5  $\mu\text{m}$  for corrosion protection. The claims differ from the previously cited prior art in calling for the protective coating to be a rare earth silicate coating. Providing a rare earth silicate coating on a silicon nitride ceramic is conventional and well known in the art as evidenced by Watanabe et al (US5118644) noting Col. 4, lines 20-28, Col. 10, lines 19-25, and Col. 3, lines 55-59 or Kamatsu (US4713302) in Col. 1, lines 40-48 wherein a silicon nitride ceramic is coated with a rare earth silicate coating to increase mechanical strength. In view of Watanabe et al (US5118644) or Kamatsu (US4713302), it would have been obvious to one of ordinary skill in the art to provide a rare earth silicate coating in lieu of the coating disclosed by Koshkarian et al (US5578349) so that a thinner protective coating is used and fabricated by merely oxidizing the surface thereof, thereby simplifying manufacture.

As indicated above claims 10 and 14 have been cancelled and new claims 15-23 have been added.

Discussion Re: Patentability of Claim 15

As previously indicated new claim 15 reads as follows:

15. A method of coating a portion of a glow plug, comprising:
  - (a) disposing a silicon-based component on said portion of said glow plug, wherein said silicon-based component includes a rare earth-doped ceramic;
  - (b) heating said silicon-based component to about 1250 C° or greater for about six to about twelve hours so as to form silica; and
  - (c) reacting said rare earth-doped ceramic with said silica so as to form a rare earth silicate coating on said silicon-based component.

Based upon the above language the Examiner will appreciate that the method of claim 15 includes (a) disposing a silicon-based component which includes a rare earth-doped ceramic on a portion of a glow plug, (b) heating the silicon-based component and the rare earth-doped ceramic so as to form silica, and (c) reacting the rare earth-doped ceramic with the silica to form a rare earth silicate coating on the silicon-based component.

Discussion Re: Koshkarian et al.

Koshkarian et al. appears to be directed to a process for applying a tantalum oxide coating on a portion of a ceramic glow plug. However, Koshkarian et al. is devoid of any discussion relating to a method of coating a portion of a glow plug which includes (a) disposing a silicon-based component which includes a rare earth-doped ceramic on a portion of a glow plug, (b) heating the silicon-based component and the rare earth-doped ceramic so as to form silica, and (c) reacting the rare earth-doped ceramic with the silica to form a coating on the silicon-based component.

In fact, Koshkarian et al. specifically teaches that the coating, i.e. tantalum oxide, is plasma sprayed on the glow plug. In particular, Koshkarian et al. states the following:

The tantalum oxide is then plasma sprayed onto the ceramic glow plug portion, forming and depositing a resultant tantalum oxide coating on the glow plug portion. Preferably, the tantalum oxide is plasma sprayed onto the ceramic glow plug portion in an atmosphere comprising argon and hydrogen. Alternatively, the atmosphere could also be a mixture of argon, nitrogen, helium and hydrogen, or combinations thereof. (see column 5, lines 31-39)

Based upon the above passage the Examiner will appreciate that Koshkarian et al. does not teach or suggest forming a rare earth silicate coating by reacting the rare earth-doped ceramic with the silica.

Discussion Re: Watanabe et al.

Watanabe et al. appears to be directed to a thermal shock-resistant silicon nitride sintered material consisting substantially of silicon nitride and rare earth element compounds. The material contains at least 10 pore groups per mm<sup>2</sup>, each pore group consisting of pores of 10 µm or less. The thermal shock-resistant silicon nitride sintered material can be produced by mixing and shaping starting materials consisting of silicon nitride powders of rare earth element oxides and carbide powder, and then firing the shaped material in a nitrogen atmosphere to decompose the carbide powders. However, Watanabe et al. is devoid of any discussion relating to a method of coating a portion of a glow plug which includes (a) disposing a silicon-based component which includes a rare earth-doped ceramic on a portion of a glow plug, (b) heating the silicon-based component and the rare earth-doped ceramic so as to form

silica, and (c) reacting the rare earth-doped ceramic with the silica to form a coating on the silicon-based component. Therefore, the proposed combination of Koshkarian et al. and Watanabe et al. does not establish a *prima facie* case of obviousness with respect to claim 15. Accordingly, Applicants submit that claim 15 is in condition for allowance and action to that end is hereby solicited.

Discussion Re: Patentability of Claims 16-23

Claims 16-23 include claim 15 as a base claim. As a result, claims 16-23 are believed to be allowable for the reasons hereinbefore discussed with regard to claim 15. Therefore, Applicants respectfully submit that claims 16-23 are in condition for allowance and action to that end is hereby solicited.

Discussion Re: Kamatsu

Kamatsu appears to be directed to a sintered ceramic body having a surface layer containing yttrium silicate, cristobalite and silicon nitride, and mainly consists of silicon nitride. The silicon ceramic body is manufactured by preparing a composition containing a silicon nitride powder and an yttrium oxide powder, forming and sintering the composition, and heat-treating the sintered body in an oxidizing atmosphere. Like Watanabe et al., Kamatsu is devoid of any discussion relating to a method of coating a portion of a glow plug which includes (a) disposing a silicon-based component which includes a rare earth-doped ceramic on a portion of a glow plug, (b) heating the silicon-based component and the rare earth-doped ceramic so as to form silica, and (c) reacting the rare earth-doped ceramic with the silica to form a coating on the silicon-based component. Therefore, the proposed combination of

Koshkarian et al. and Kamatsu does not establish a *prima facie* case of obviousness with respect to claim 15. Accordingly, Applicants submit that claim 15 is in condition for allowance and action to that end is hereby solicited.

Discussion Re: Patentability of Claims 16-23

Claims 16-23 include claim 15 as a base claim. As a result, claims 16-23 are believed to be allowable for the reasons hereinbefore discussed with regard to claim 15. Therefore, Applicants respectfully submit that claims 16-23 are in condition for allowance and action to that end is hereby solicited.

**35 U.S.C. § 103(a) Rejection of Claims 10 and 14 (Watanabe et al. '644 or Kamatsu '302 in view of Koshkarian et al '349)**

Claims 10 and 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Watanabe et al. (U.S. Patent No. 5,118,644) or Kamatsu (U.S. Patent No. 4,713,302) in view of Koshkarian et al. (U.S. Patent No. 5,578,349). Specifically the Examiner states the following on page 2, line 21 through line 29 of the office action:

The claims differ from the previously cited prior art in calling for a glow plug. The use of silicon nitride as a main glow plug material is well known in the art as shown by Koshkarian et al (US5578349) wherein the material is used due to its ability to withstand elevated temperatures and thermal shock resistance. Furthermore, the general use of silicon nitride materials for glow plugs is conventional in the art. In view of Koshkarian et al (US5578349), it would have been obvious to one of ordinary skill in the art to incorporate the teachings of coating the silicon nitride material with a rare earth silicate coating in a glow plug in order to increase the corrosion resistance of the glow plug.

Applicants respectfully submit that claims 15-23 are patentable over the proposed combination of Watanabe et al.

or Kamatsu in view of Koshkarian et al. for the same reasons discussed above in reference to the Koshkarian et al. in view of Watanabe et al. or Kamatsu rejection.

**Conclusion**

In view of the foregoing remarks, it is submitted that this application is in condition for allowance. Action to that end is hereby solicited.

Respectfully submitted,

  
\_\_\_\_\_  
Bradford G. Addison  
Attorney for Applicants  
Registration No. 41,486

January 9, 2001

Maginot, Addison & Moore  
Bank One Tower  
111 Monument Circle, Suite 3000  
Indianapolis, Indiana 46204-5130  
Phone: (317) 638-2922  
Fax: (317) 638-2139